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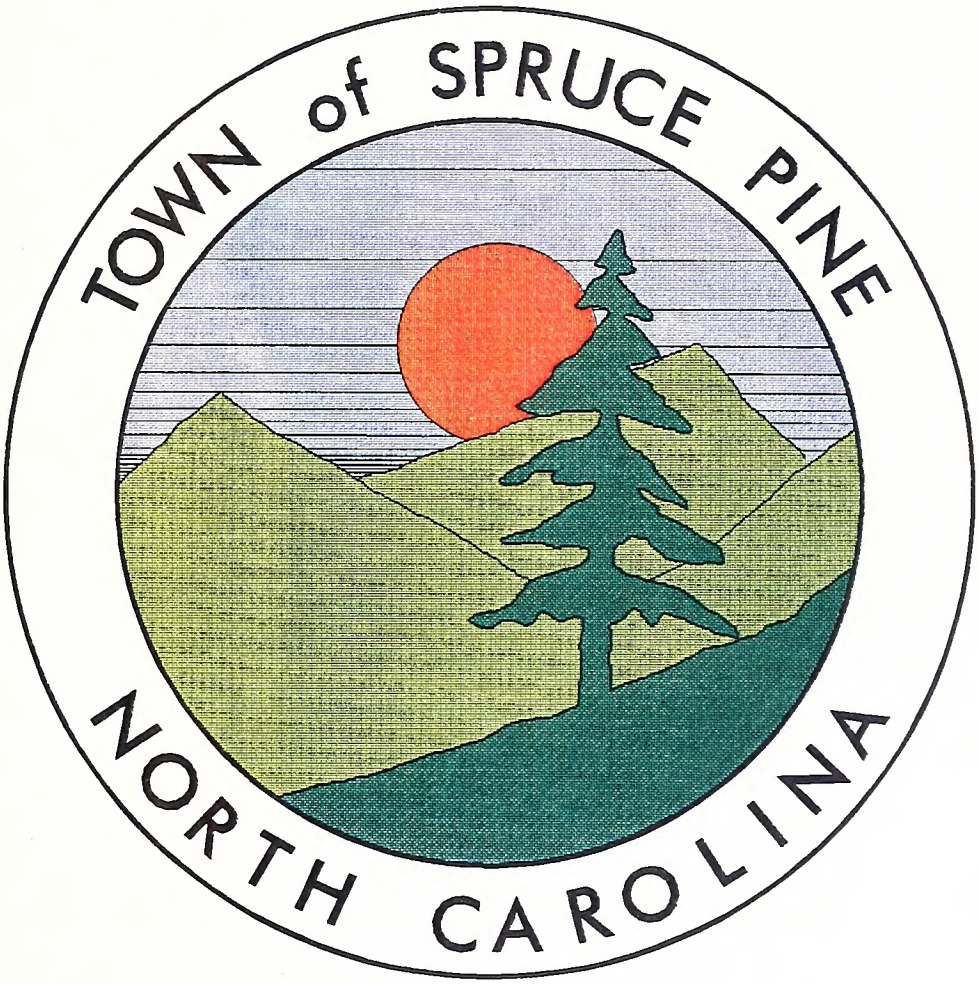
North Carolina Department of Transportation
Statewide Planning Branch
Small Urban Planning Unit

Thoroughfare Plan

for



February, 1994

Thoroughfare Plan

For

SPRUCE PINE, NORTH CAROLINA

Prepared by the:

Statewide Planning Branch
Division of Highways
N. C. Department of Transportation

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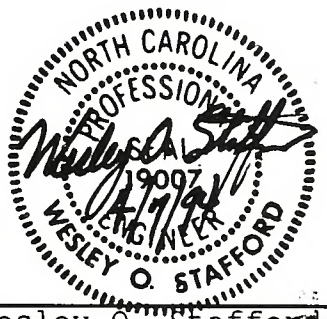

Wesley O. Stafford, P.E.
Small Urban Planning Engineer

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90 copies of this document were printed at a cost of $296.20
or $3.29 per copy (GS 143-170.1).

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I. Introduction

Spruce Pine is located in the southern part of Mitchell County in western North Carolina (See Figure 1). It is Mitchell County's largest city and serves as the regional shopping center for the Mitchell-Avery-Yancey County area. Highway access is by US 19E and NC 226. US 19E runs east to west through town while NC 226 runs north to south.

The Town of Spruce Pine requested the North Carolina Department of Transportation, Statewide Planning Branch, conduct a thoroughfare planning study for the area in response to concerns of how the upcoming Mimpro Bypass would affect to traffic situation in town. Town Aldermen, Planning/Zoning Board members, and local citizens participated in discussions of the transportation needs of the area. Following a public hearing on December 13, 1993 the Town of Spruce Pine adopted the thoroughfare plan. The plan was subsequently adopted by the North Carolina Department of Transportation on February 4, 1993.

The thoroughfare plan was developed following the basic planning principles described in Chapter V of this report. Major thoroughfares were located based on field investigations, existing and anticipated land uses, and topographic considerations. The purpose of the plan is to facilitate the flow of traffic to desired destinations with as little resistance as possible.

Responsibility for the proposed construction is shared by the Town of Spruce Pine and the North Carolina Department of Transportation. In order for the plan to be effective, both the Town and the State must protect by various legal controls, such as subdivision regulations, the rights of way necessary for the improvements which will ultimately be required.

It should be emphasized that the recommended thoroughfare plan is based on the current anticipated growth of the area as discussed by the Town and project engineer. Prior to construction of specific projects a more detailed examination will be required to reconsider development trends and to determine design requirements.

Geographic Location

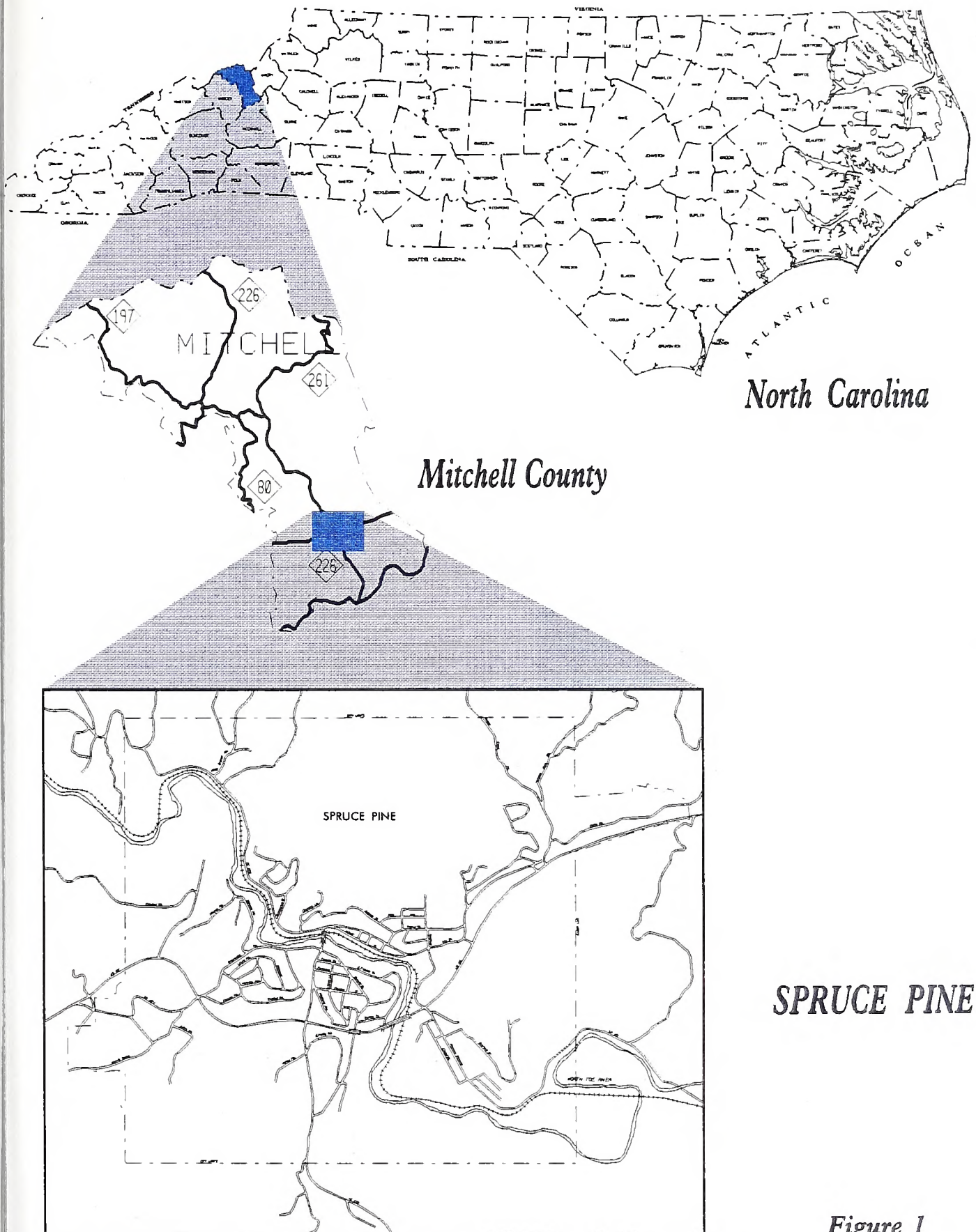


Figure 1

II. Recommended Thoroughfare Plan

A thoroughfare plan study uncovers the need for new facilities, plus identifies existing and future deficiencies in the transportation system. The thoroughfare plan is a representation of the existing highway system by functional use, e.g., major thoroughfares, minor thoroughfares plus any new facilities which are needed. The planning methodology enables identification of deficiencies in the existing system, allowing compilation of a list of needed improvements.

This chapter presents an analysis and makes recommendations based on the ability of the existing street system to serve the present and future travel desires as the area continues to grow. The usefulness of transportation planning is in the analysis of different highway configurations for their efficiency in serving the area. The recommended plan sets forth a system of thoroughfares to serve the anticipated traffic and land development needs for the Spruce Pine area. The need to eliminate existing and projected system deficiencies which cause traffic congestion is the primary objective of the plan.

A brief discussion of the classified roads in the Spruce Pine Thoroughfare Plan is included in the following section. The recommended plan itself is shown in **Figure 2**. Specific details on physical and operational characteristics are given in **Appendix A, Table 5**.

Recommendations

Recommended improvements to major thoroughfares include:

NC 226 (Southern Planning Boundary to US 19E) - This portion of NC 226 is currently programed in the TIP as project R-2598. R-2598, as currently stated, upgrades the existing two lane roadway. However, a large portion of the future growth is expected in this area along with significant increases in traffic, so it is recommended that this section of roadway be widened to five lanes with curb and gutter. This proposed roadway would sufficiently handle anticipated traffic and facilitate development in this area.

NC 226 (SR 1275 to Northern Planning Boundary) - This roadway is currently 20 - 22 feet in width and provides access to downtown from the northwest. It is narrow and curvy with considerable traffic. Widening the roadway to 24 feet, improving shoulders, and adding guardrails are recommended for this stretch of highway.

Altapass Highway (SR 1121) - SR 1121 currently handles over 2000 vehicles per day and is 20 feet in width. It is recommended that the roadway be upgraded to 24 feet in width.

NC 226 (Mimpro Bypass TIP# R-2119) - Retain construction of the currently scheduled project. Existing NC 226 north of Spruce Pine is approaching, or is at capacity in several locations. The bypass will ease congestion and reduce the amount of truck traffic rolling through downtown.

Recommended improvements to minor thoroughfares include:

SR 1122 - Recommend widening to 24 feet. This minor thoroughfare connects US 19E and SR 1121.

Major Thoroughfares

Other major thoroughfares include:

US 19E - This highway serves as the major carrier for east-west traffic. It is designated as an Intrastate Highway and is important to Spruce Pine and the regions' effort to promote tourism and economic development. The majority of US 19E through Spruce Pine is a four lane facility, however, sections east and west of town are two lanes. These sections of roadway are scheduled in the TIP to be upgraded to multilane sections due to US 19E's designation as an Intrastate Highway.

Greenwood Road (SR 1274) - This road serves the western part of town and several different land uses. There is shopping near downtown, residential sections straddling US 19E, and industrial and public land uses near the western city limits. Design year traffic projections do not warrant improving this facility.

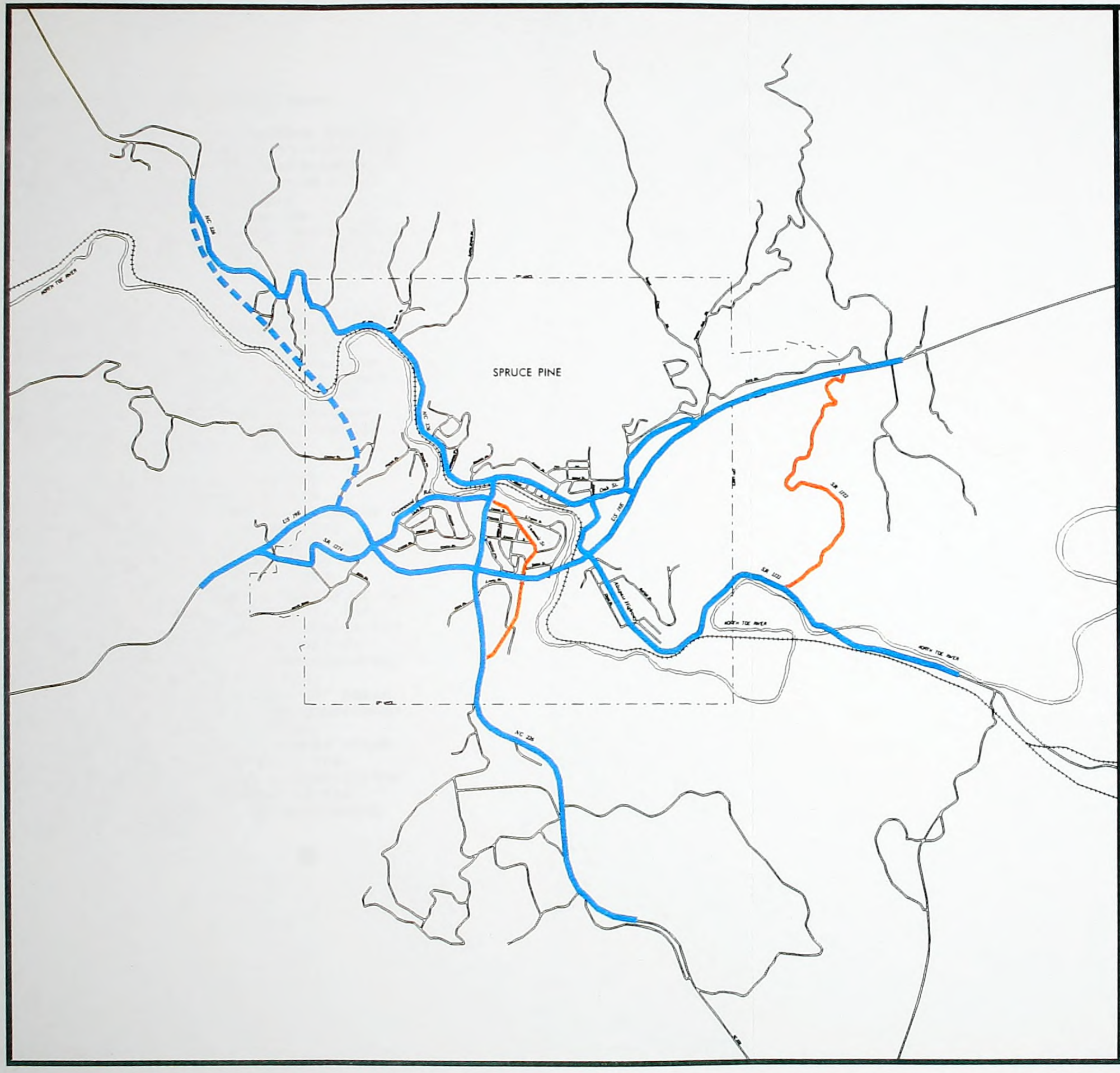
Oak Street (SR 1275) - Oak Street runs through downtown and thus serves one of the major commercial areas of Spruce Pine. Once the Mimpro bypass (TIP# 2119) is constructed, the facility will adequately handle projected traffic.

SR 1285 - SR 1285 runs concurrently with Oak Street and also serves a commercial area. It will also sufficiently handle future traffic once the Mimpro Bypass (TIP# 2119) is completed.

Minor Thoroughfares

Other minor thoroughfares include:

Summit Street (SR 1274) - This road primarily serves as access to the south-central portion of the town which includes residential areas, the Pinebridge Coliseum, and an industrial facility. It does not have much potential for growth and is currently adequate to meet future traffic demand.



LEGEND

	existing	*proposed*
Major Thoroughfare	▬	▬ ▬
Minor Thoroughfare	▬	▬ ▬

Adopted by:

Spruce Pine — DECEMBER 13, 1993

Recommended by Statewide Planning Branch — DECEMBER 17, 1993

NC Dept. of Transportation — FEBRUARY 4, 1994

Public Hearing — DECEMBER 13, 1993

FIGURE 2

THOROUGHFARE PLAN

SPRUCE PINE

Mitchell County

North Carolina

N

0 800 1600 2400

scale in feet

November 22, 1993

Benefits Evaluation of Major Recommendations

To be in the State's Transportation Improvement Program, a project must show favorable benefits relative to costs and should not be prohibitively disruptive to the environment. Three principal measures of benefits were used: road user cost savings, the potential for increased economic development resulting from the improvement, and the environmental impact, both positive or negative, which might result. The first measure is an actual estimate of dollar savings, while the others are estimates of the probability of the resulting change.

Reduced road user costs should result from any roadway improvement, from a simple widening to the construction of a new roadway to relieve congested or unsafe conditions. Comparisons of the existing and the proposed facility have been made in terms of vehicle operating costs, and accident costs. these user benefits are computed as total dollar savings over the design period using data such as project length, base year and design year traffic volumes, traffic speed, type of facility, and volume/capacity ratio.

The impact of a project on economic development potential is denoted as the probability that it will stimulate the economic development of an area by providing access to land with development potential and reducing transportation costs. It is a subjective estimate based on characteristics, and land development potential. The probability is rated on a scale from 0 (none) to 1.00 (excellent). The environmental impact analysis considers the effect of a project on the physical, social/cultural, and economic environment. Many of these have been accounted for in evaluating the project with respect to user benefits, cost, and economic development potential. The Environmental analysis evaluates the impact of the project on the following: (1) air quality, (2) water resources, (3) soils and geology, (4) wildlife, (5) vegetation, (6) neighborhoods, (7) noise, (8) educational facilities, (9) churches, (10) parks and recreational facilities, (11) historic sites and landmarks, and (12) public health and safety. The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impact of a project. Environmental considerations are highlighted in **Table 1**.

Offsetting the benefits that would be derived from any project is the cost of its construction. A new facility, despite its high projected benefits, might prove to be unjustified due to the excessive costs involved in construction. The highway costs estimated in this report are based on the average statewide construction costs for similar project types. **Table 2** lists the major recommended Spruce Pine project with respect to user benefits, estimated costs, probability of economic development, and environmental impact.

TABLE 1

ENVIRONMENTAL CONSIDERATIONS		
Physical Environment	Social and/or Cultural Environment	Economic Environment
Air Quality Water Resources Wildlife Vegetation	Housing Neighborhoods Noise Education Facilities Churches Park and Recreational Facilities Public Health and Safety National Defense Aesthetics	Businesses Employment Economic Development Public Utilities Transportation Costs Capital Costs Operation and Maintenance Costs

TABLE 2
BENEFITS EVALUATION

Project	Benefits (1000s)	Costs (1000s)	Length Mile	Benefit Per Mile	Econ. Benefit	Environ. Impact
NC 226 Southern Planning Boundary to US 19E	37,078	4,800	2.03	18,265	+0.5	+0.6 -0.4

III. IMPLEMENTATION

Implementation is one of the most important aspects of the thoroughfare plan. Unless implementation is an integral part of this process, the effort and expense associated with developing the plan is lost. There are several tools available for use by the Town to assist in the implementation of the plan. They are as follows:

State-Municipal Adoption of the Thoroughfare Plan

The Town of Spruce Pine and the North Carolina Department of Transportation have mutually approved the thoroughfare plan shown in **Figure 2**. The mutually approved plan will serve as a guide for the Department of Transportation in the development of the road and highway system for the town. The approval of the plan by the town also enables standard road regulations and land use controls to be used effectively in the implementation of this plan. As part of the plan, the Town and the Department of Transportation shall reach agreement on the responsibilities for existing and proposed streets and highways. Facilities which are designated a State responsibility will be constructed and maintained by the Division of Highways. Facilities which are designated a municipal responsibility will be constructed and maintained by the municipality.

Subdivision Controls

Subdivision regulations require every subdivider to submit to the County Planning Commission a plan of any proposed subdivision. It also requires that subdivisions be constructed to certain standards. Through this process, it is possible to require the subdivision streets to conform to the thoroughfare plan and to reserve or protect necessary right-of-way for protected roads and highways that are to become a part of the thoroughfare plan. The construction of subdivision streets to adequate standards reduces maintenance costs and simplifies the transfer of streets to the State Highway System. **Appendix B** outlines the recommended subdivision design standards as they pertain to road construction.

Land Use Controls

Land use regulations are an important tool in regulating future land development and minimizing undesirable development along roads and highways. The land use regulatory system can improve highway safety by requiring sufficient setbacks to provide for adequate sight distances and by requiring off-street parking.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the Department of Transportation. In addition, any development expected to generate large volumes of traffic (e.g., shopping centers, fast food restaurants, or large industries) may be comprehensively studied by staff from the Traffic Engineering Branch, Planning and Environmental Branch, and/or Roadway Design Unit of the North Carolina Department of Transportation (DOT). If done at an early stage, it is often possible to significantly improve the development's accessibility while preserving the integrity of the thoroughfare plan.

Funding Sources

Capital Improvements Program

A capital improvement program makes it easier to build a planned thoroughfare system. This capital improvement program consists of two lists of projects. The first is a list of highway projects that are designated as a municipal responsibility and are to be implemented with municipal funds. The second is a list of local projects designated as the State's responsibility to be included in the Transportation Improvement Program.

Transportation Improvement Program

North Carolina's Transportation Improvement Program (TIP) is a document which lists all major construction projects the DOT plans for the next seven years. Similar to local Capital Improvement Program projects, TIP projects are matched with projected funding sources. Each year when the TIP is updated, completed projects are removed, programed projects are advanced, and new projects are added.

During annual TIP public hearings, municipalities request projects to be included in the TIP. A Board of Transportation member reviews all of the project requests in a particular area of the state. Based on the technical feasibility, need, and availability of funding, the board member decides which projects will be included in the TIP. In addition to highway construction and widening, TIP funds are available for bridge replacement projects, highway safety projects, public transit projects, railroad projects, and bicycle projects.

Industrial Access Funds

If an Industry wishes to develop property that does not have access to a state maintained highway and certain economic conditions are met, then funds may be made available for construction of an access road.

Small Urban Funds

Small Urban funds are annual discretionary funds made to municipalities with qualifying projects. The maximum amount is $300,000 per year per project. A Town may have multiple projects. Requests for Small Urban Fund assistance should be directed to the appropriate Board of Transportation member and Division Engineer.

The North Carolina Highway Trust Fund Law

The highway Trust Fund Law was established in 1989 as a 13.5 year plan four major goals for North Carolina's roads and highways. These goals are:

1. To complete the remaining 1,716 miles of four lane construction on the 3,600 mile North Carolina Intrastate System.

2. To Construct a multilane connector in Asheville and portions of multilane loops in Charlotte, Durham, Greensboro, Raleigh, Wilmington, and Winston-Salem.

3. To supplement the secondary roads appropriation in order to pave, by 1999, 10,000 miles of unpaved secondary roads carrying 50 or more vehicles per day, and all other unpaved secondary roads by 2006.

4. To supplement the Powell Bill Program.

For more information on the Highway Trust Fund Law, contact the Program Development Branch of the DOT.

Table 3 details Funding Sources and Methods of Implementation for recommended improvements.

Table 3

Funding Sources and Methods Recommended for Implementation of Projects									
PROJECT	Funding Sources				Methods of Implementation				
	Local Funds	TIP Funds	Indust. Access	Small Urban	T-fare Plan	Subdiv. Ord.	Zoning Ord.	Future Street Lines	Development Review
NC 226 Widening Southern Planning Boundary to US 19E		X					X		X
NC 226 SR 1275 to Proposed Mimpro Bypass		X				X	X		X
Altapass Highway SR 1121		X		X		X	X		X
SR 1122		X		X			X		X

IV. EXISTING AND PROJECTED CONDITIONS

Factors Affecting Transportation

The factors of population, land use and traffic play a vital role in determining the transportation needs of a city. Examination of these factors helps to explain historic travel patterns and lays the groundwork for thoroughfare planning.

In order to formulate an adequate year 2020 thoroughfare plan, reliable forecasts of future travel characteristics must be achieved. The factors of population, vehicle usage trends, economy, and land use play a significant role in determining the transportation needs of the area, and must be carefully analyzed. Additional items may include the effects of legal controls such as subdivision regulations and zoning ordinances, availability of public utilities and physical features of the area.

The first step in the development of the thoroughfare plan is to define the planning period and the planning area. The planning period is typically on the order of 30 years. The base year for the Spruce Pine study was 1993, and the year 2020 was chosen to be the end point of the study period (27 years). The planning area is generally the limits to which urbanization is expected to occur during the planning period. the planning area is then subdivided into traffic analysis zones. **Figure 3** shows the planning area boundary and zones.

Economy and Employment

Mining and industry are both important employers in and around Spruce Pine. Several minerals, such as feldspar and mica, are mined around Spruce Pine. The mining operations, including the mines and associated processing facilities, are primarily located in the northwestern part of the planning area. Other industries include Hampshire Hosiery, located off of Summit Avenue, and several furniture manufacturers and furniture finishers.

Other sources of employment include the central business district (CBD) around Locust and Oak Streets. In addition, a large shopping area is located on NC 226 in the southern portion of the planning area. Also, another shopping center is located on Greenwood Road between US 19E and NC 226.

Population

Travel is directly related to population. The volume of traffic on any road is a direct result of the size and distribution of an area's population. The population of Mitchell county has exhibited an up and down trend in the past, but is projected to decline over the next 30 years.

The 1992 population of the planning area was derived from the estimated 1992 population of Grassy Creek Township. The 1992 planning area population was assumed to 70% of the township's population. After discussing the planning area's growth potential with the Spruce Pine planning board, a growth rate of 1/2% per year was used to project the 2020 planning area population. Population trends and projections are shown in **Table 4**.

TABLE 4

POPULATION TRENDS AND PROJECTIONS					
YEAR	**1960**	**1970**	**1980**	**1992**	**2020**
Mitchell Co.	13,906	13,447	14,428	14,401	13,109
Grassy Creek Township	6,052	6,116	6,845	7,121	6,502
Planning Area	*****	*****	*****	5,000	5,749

NOTE: Population data for Mitchell County and Grassy Creek Township was obtained from the Office of State Planning.

Land Use

The generation of traffic on a particular street is closely related to the adjacent land use. Attraction between different land uses varies with the intensity and spatial separation of the uses. As a result, for the purpose of transportation planning, it is necessary to designate land use by type. An analysis of the distribution of existing land uses serves as a basis for forecasting future land use needs and the resulting travel patterns.

For thoroughfare planning purposes, the land uses were grouped into four broad categories: (1) Residential - all land devoted to the housing of people, with the exception of hotels and motels; (2) Commercial - all land devoted to retail trade, including consumer and business services and offices; (3) Industrial - all land devoted to manufacturing, storage, warehousing, and transportation of products; and (4) Public - all land devoted to social, religious, educational, cultural, and political activities.

The Spruce Pine planning area's land use is shown in **Figure 4**.

Legend

Planning Area Boundary

Screen Lines

Zone Boundaries

Zone Number 7

FIGURE 3

ZONE MAP

SPRUCE PINE

Mitchell County

North Carolina

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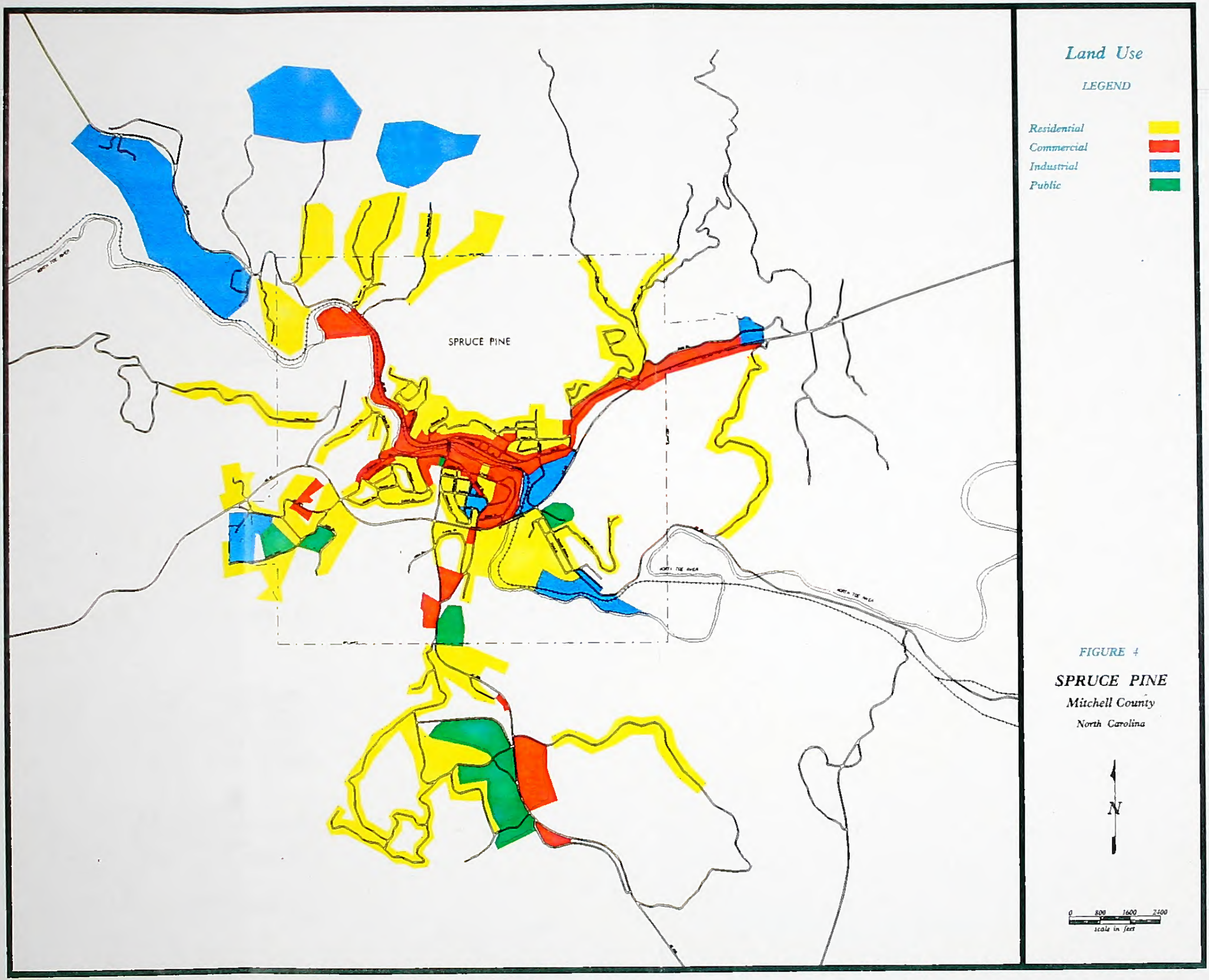
0 800 1600 2400

scale in feet


Land Use
LEGEND
Residential
Commercial
Industrial
Public
SPRUCE PINE
FIGURE 4
SPRUCE PINE
Mitchell County
North Carolina
N
0 800 1600 2400
scale in feet

Existing Highway System

Currently, Spruce Pine is served by US 19E and NC 226. US 19E is currently a four lane highway inside the town limits and runs east-west. Outside the town limits, US 19E is a two lane highway. US 19E has been designated as an Intrastate Highway, and as such the two lane portions have been programed in the T.I.P. for improvement to four lanes. NC 226 is primarily a two lane facility, with some three lane sections, in most of the planning area. It runs north-south and passes through the center of town. A NC 226 Bypass, located on the west side of town, is currently scheduled in the T.I.P.

US 19E, with its programed improvements, should adequately meet foreseeable traffic demand through the design period. NC 226 has seen significant increases in traffic and that trend is expected to continue. Therefore, a significant upgrade is recommended from the southern planning boundary to the intersection with US 19E.

The existing system is shown with current and projected traffic in **Figure 5**.

Traffic Accidents

Accident records for 1986 through 1991 were studied for the Spruce Pine planning area. The majority of accidents occurred along US 19E and NC 226. Another area with a high incidence of accidents is the CBD along Oak Street, accidents along this route will probably decrease with the construction of the NC 226 Bypass, which is expected to alleviate traffic in the CBD.

Figure 6 shows accident locations from 1986 to 1991 at intersections with more than 5 accidents.

Capacity Analysis

Capacity is defined as the maximum number of vehicles, under prevailing roadway and traffic conditions, that have a reasonable expectation of passing over a given time period. A comparison of capacity with actual traffic volumes is a good indicator of the adequacy of the existing major street network.

An analysis of roads in Spruce Pine was made to determine if the projected traffic (year 2020) would exceed the practical capacity of the system. Based on this analysis, only two sections of road are expected to approach their capacity within the design period:

1. NC 226 from its intersection with US 19E to the southern planning boundary.

2. NC 226 from Oak Street (SR 1275) to the northern planning boundary.

In an urban area, a street's ability to move traffic is generally controlled by the spacing of major intersections, the pavement width, and the type and number of traffic control devices. These characteristics can be manipulated to increase the capacity and improve the level of service.

The level of service is a function of the ease of movement experienced by motorists using the facility. Six levels of service, shown in **Figure 7**, have been selected to identify conditions existing under various speed and volume conditions on any highway or street. The six levels of service are:

1. **Level of service A** - represents free flow with low traffic volumes and high speeds. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided is excellent.

2. **Level of service B** - also represents reasonably free flow conditions. The ability to maneuver within the traffic stream is only slightly restricted.

3. **Level of service C** - provides for stable operations, but flows approach the range in which small increases will cause substantial deterioration in service. Minor incidents may still be absorbed, but the local decline in service will be great.

4. **Level of service D** - borders on unstable flow. small increases in flow can cause substantial deterioration in service. Freedom to maneuver is severely limited, and the driver experiences drastically reduced comfort levels. On an urban arterial, LOS D corresponds to and average travel speed of 9 to 17 mph.

5. **Level of service E** - The boundary between LOS D and LOS E describes operation at **capacity**. Operations at this level are extremely unstable, because there are virtually no usable gaps in the traffic stream. Any disruption to the traffic stream, such as a vehicle entering from a ramp, or changing lanes, requires the following vehicles to give way to admit the vehicle. Any incident can be expected to produce a serious breakdown with extensive queuing.

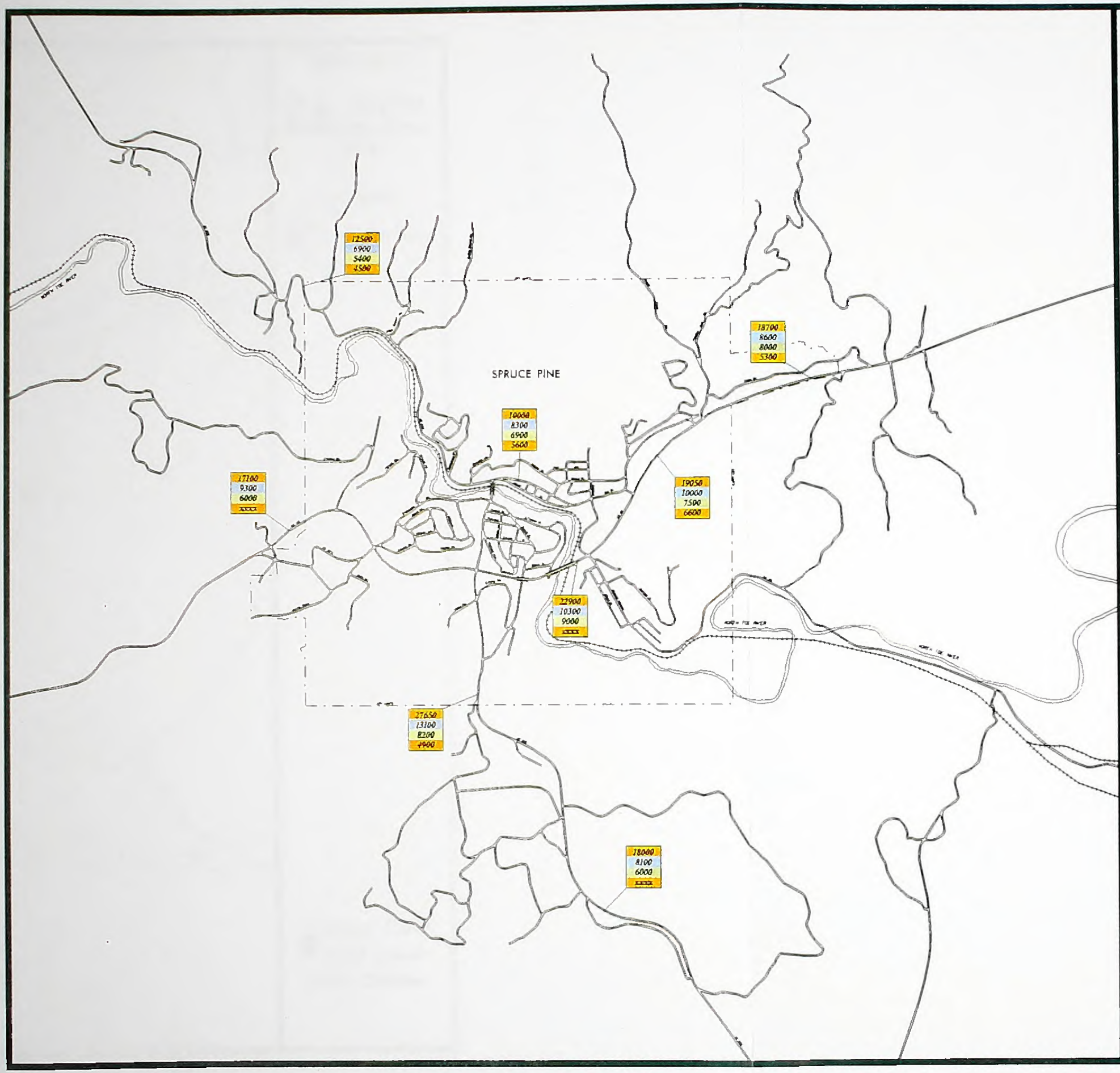
6. **Level of service F** - describes forced or breakdown flow. Such conditions generally exist within queues forming behind breakdown points.

Figure 5

Historic and Projected Traffic on Existing System

LEGEND

2020 ADT	2020
1992 ADT	1992
1986 ADT	1986
1976 ADT	1976



SPRUCE PINE

Mitchell County

North Carolina

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scale in feet

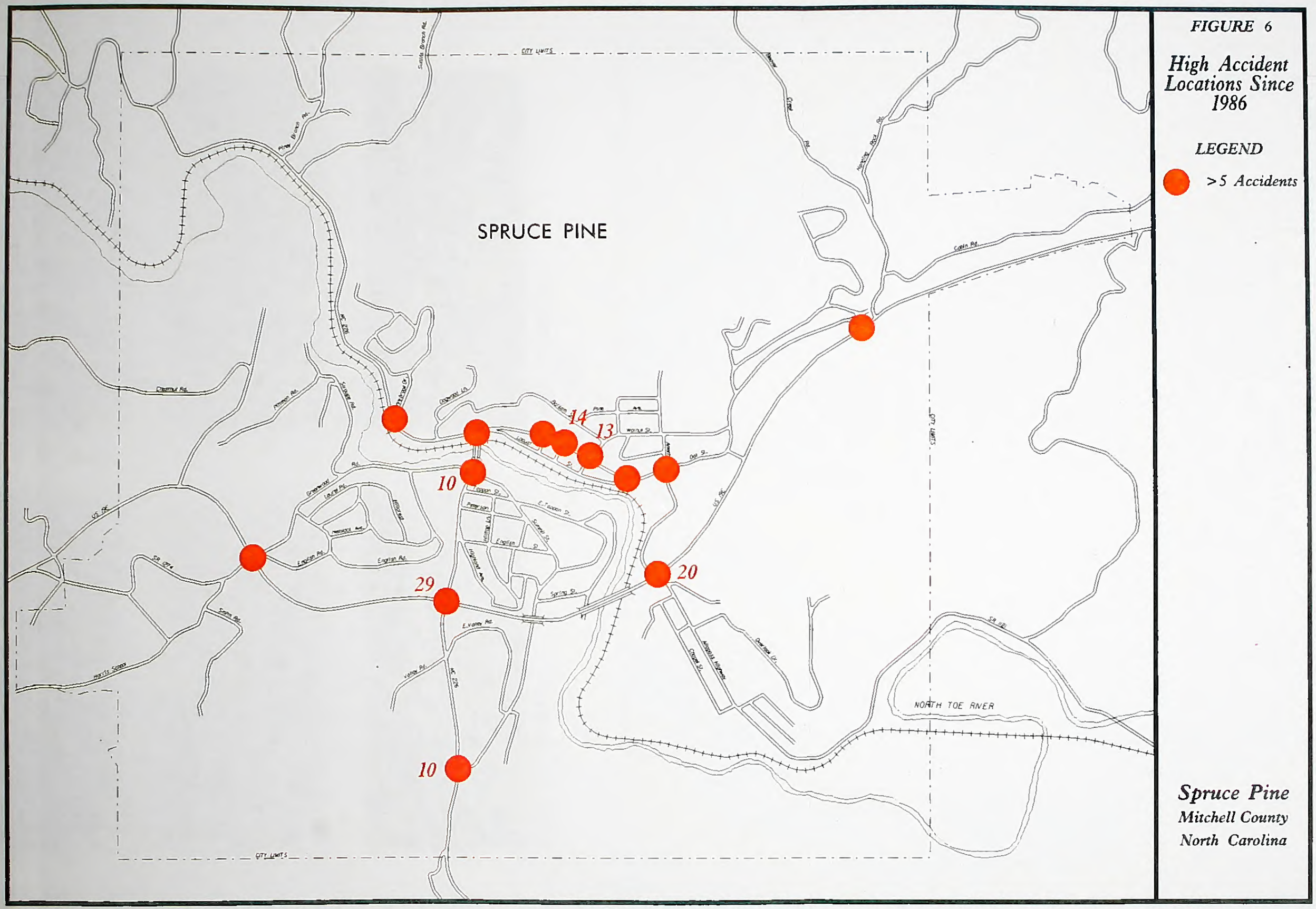


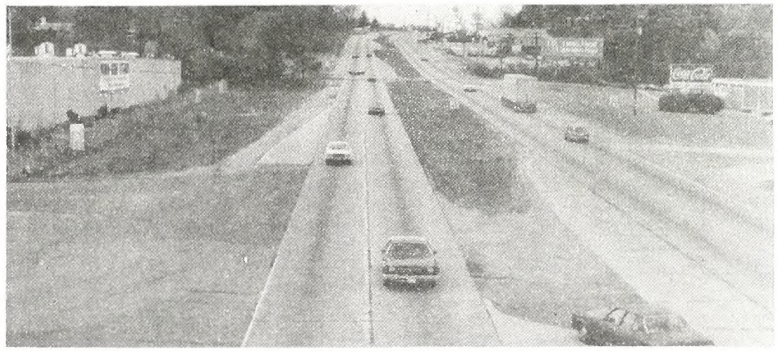
FIGURE 6

High Accident Locations Since 1986

LEGEND

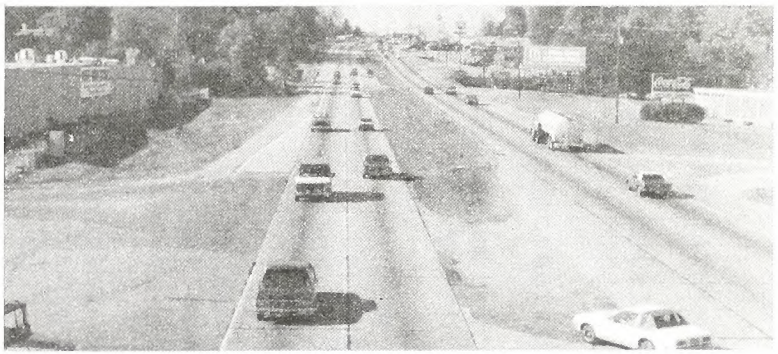
>5 Accidents

Spruce Pine
Mitchell County
North Carolina



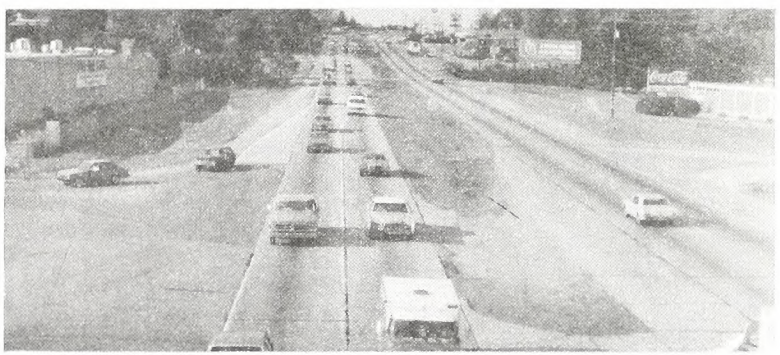
LEVEL OF SERVICE - A

LEVEL OF SERVICE - D



LEVEL OF SERVICE - B

LEVEL OF SERVICE - E



LEVEL OF SERVICE - C

LEVEL OF SERVICE - F

LEVELS OF SERVICE

FIGURE 7

V. Thoroughfare Planning Principles

Objectives

Typically, the urban street system occupies 25 to 30 percent of the total developed land in an urban area. Since the system is permanent and expensive to build and maintain, much care and foresight are needed in its development. Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system that will meet existing and future travel desires within the urban area.

The primary aim of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with the changing traffic patterns. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and it helps eliminate unnecessary improvements, so needless expense can be averted. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained, requiring a minimum amount of land for street purposes. In addition to providing for traffic needs the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial and industrial development affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

1. providing for the orderly development of an adequate major street system as land development occurs,

2. reducing travel and transportation costs,

3. reducing the cost of major street improvements to the public through the coordination of the street system with private action,

4. enabling private interests to plan their actions, improvements, and development with full knowledge of public intent,

5. minimizing disruption and displacement of people and businesses through long range advance planning for major street improvements,

6. reducing environmental impacts, such as air pollution, resulting from transportation, and

7. increasing travel safety.

Thoroughfare planning objectives are achieved through both improving the operational efficiency of thoroughfares, and improving the system efficiency through system coordination and layout.

Operational Efficiency

A street's operational efficiency is improved by increasing the capability of the street to carry more vehicular traffic and people. In terms of vehicular traffic, a street's capacity is defined by the maximum number of vehicles which can pass a given point on a roadway during a given time period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include street widening, intersection improvements, improving vertical and horizontal alignment, and eliminating roadside obstacles. For example widening of a street from two to four lanes more than doubles the capacity of the street by providing additional maneuverability for traffic. This reduces the impedances to traffic flow caused by slow moving or turning vehicles and the adverse effects of horizontal and vertical alignments.

Operational ways to improve street capacity include:

1. Control of access -- a roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number.

2. Parking removal -- Increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking and unparking vehicles.

3. One-way operation -- The capacity of a street can sometimes be increased 20-50%, depending upon turning movements and overall street width, by initiating one-way traffic operations. One-way streets can also improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.

4. Reversible lane -- Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.

5. Signal phasing and coordination -- Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways:

1. Encourage people to form carpools and vanpools for journeys to work and other trip purposes. This reduces the number of vehicles on the roadway and raises the people carrying capability of the street system.

2. Encourage the use of transit and bicycle modes.

3. Encourage industries, businesses, and institutions to stagger work hours or establish variable work hours for employees. This will spread peak travel over a longer time period and thus reduce peak hour demand.

4. Plan and encourage land use development or redevelopment in a more travel efficient manner.

System Efficiency

Another means for altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost to the user. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Functional Classification

Streets perform two primary functions -- traffic service and land service, which when combined, are basically incompatible. The conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely used abutting property leads to intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets which permits travel from origins to destinations with directness, ease, and safety. Different streets in the system are designed and called on to perform specific functions, thus minimizing the traffic and land service conflict. Streets are categorized as to function as local access streets, minor thoroughfares, or major thoroughfares.

Local Access Streets provide access to abutting property. They are not intended to carry heavy volumes of traffic and should be located such that only traffic with origins and destinations of the streets could be served.

Local streets may be further classified as either residential, commercial, and/or industrial depending upon the type of land use which the serve.

Minor Thoroughfares are more important streets on the city system. They collect traffic from local access streets and carry it to the major thoroughfares. They may in some instances supplement the major thoroughfare system by facilitating minor through traffic movements. A third function that may be performed is that of providing access to abutting property. They should be designed to serve limited areas so that their development as major thoroughfares will be prevented.

Major Thoroughfares are the primary traffic arteries of the city. Their function is to move intra-city and inter-city traffic. The streets which comprise the major thoroughfare system may also serve abutting property, however, their principle function is to carry traffic. They should not be bordered by uncontrolled strip development because such development significantly lowers the capacity of the thoroughfare to carry traffic and each driveway is a danger and impediment to traffic flow. Major thoroughfares may range from a two-lane street carrying minor traffic volumes to major expressways with four or more traffic lanes. Parking normally should not be permitted on major thoroughfares.

Idealized Major Thoroughfare System

A coordinated system of major thoroughfares forms the basic framework of the urban street system. A major thoroughfare system which is most adaptable to desire lines of travel within an urban area is the radial-loop system. It permits movement between various areas of the city within maximum directness. This system consists of several functional elements--radial streets, crosstown streets, loop system streets, and bypasses (**Figure 8**).

Radial streets provide for traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this problem, it is very important to have a system of crosstown streets which form a loop around the central business district. This system allows traffic moving from origins on

IDEALIZED THOROUGHFARE PLAN

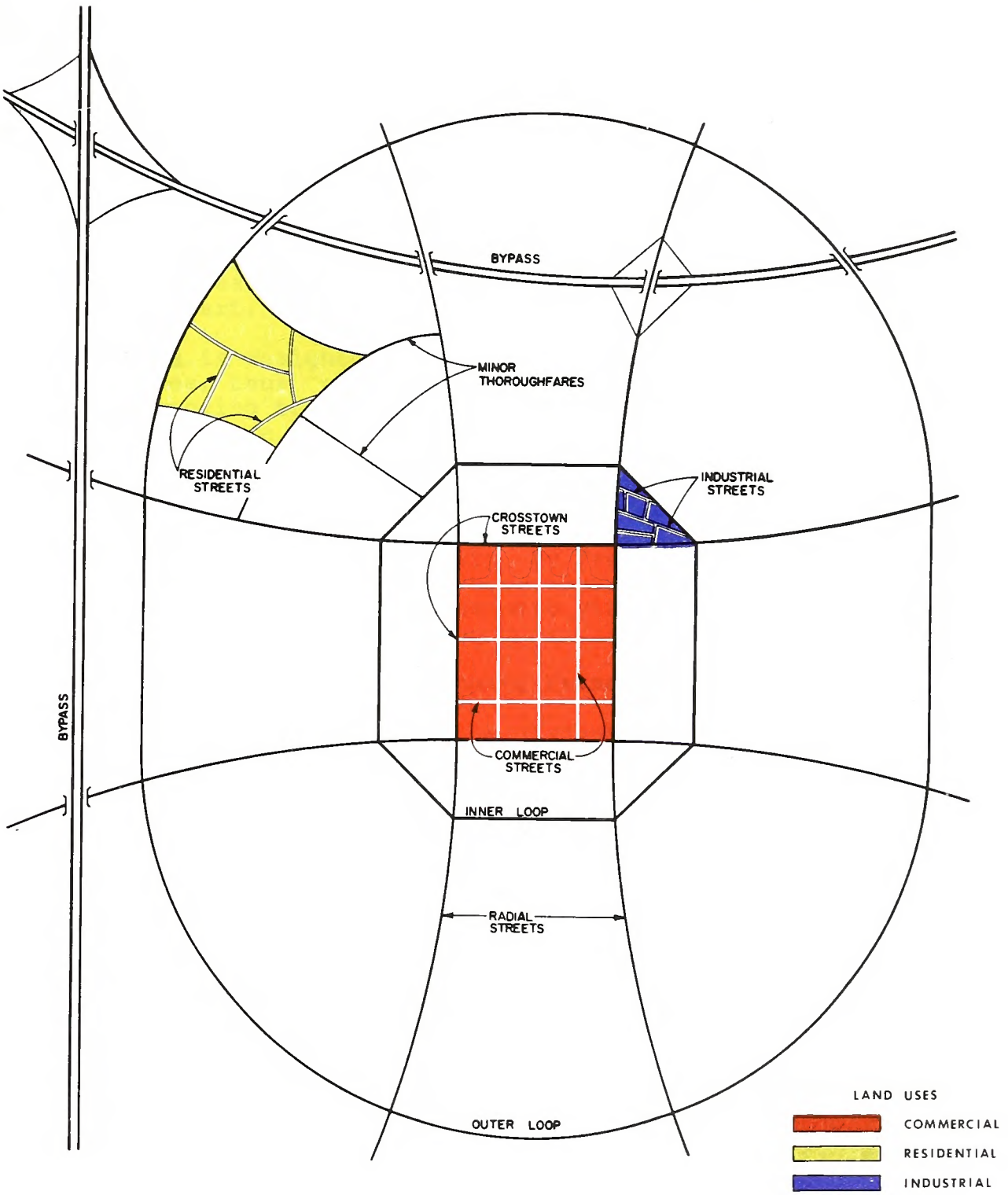


FIGURE 8

one side of the central area to destinations on the other side to follow the area's border. It also allows central area traffic to circle and then enter the area near a given destination. The effect of a good crosstown system is to free the central area of crosstown traffic, thus permitting the central area to function more adequately in its role as a business or pedestrian shopping area.

Loop system streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. loop streets do not necessarily carry heavy volumes of traffic, but they function to help relieve central areas. There may be one or more loops, depending on the size of the urban area. They are generally spaced one-half mile to one mile apart, depending on the intensity of land use.

A bypass is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing traffic which has no desire to be in the city. Bypasses are usually designed to through-highway standards, with control of access. Occasionally, a bypass with low traffic volume can be designed to function as a portion of an urban loop. The general effect of bypasses is to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area.

Application of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, functional classification, and idealized major thoroughfare system are the conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, a thoroughfare plan is developed for established urban areas and is constrained by the existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these constraints and the many other factors that affect major street locations.

Throughout the thoroughfare planning process it is necessary from a practical viewpoint that certain basic principles be followed as closely as possible. These principles are as follows:

(1) The plan should be derived from a thorough knowledge of today's travel - its component parts as well as factors that contribute to it, limit it, and modify it.

(2) Traffic demands must be sufficient to warrant the designation and development of each major street. The thoroughfare plan should be designed to accommodate a large portion of all major traffic movements on a relatively few streets.

(3) The plan should conform to and provide for the land development plan of the area.

(4) Certain considerations must be given to urban development beyond the current planning period. Particularly in outlying or sparsely developed areas which have development potential, it is necessary to designate thoroughfares on a long-range planning basis to protect right-of-way for future thoroughfare development.

(5) While being consistent with the above principles and realistic in terms of travel trends, the plan must be economically feasible.

APPENDICES

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APPENDIX A

TYPICAL CROSS SECTIONS

Typical cross sections recommended by the Statewide Planning Branch are shown in the following diagrams of **Figure 9.**

Cross section "A" is illustrative of controlled access freeways. The 46 foot grassed median is the least desirable median width, but there could be some variation from this depending upon design considerations. Slopes of 8:1 into 3 foot drainage ditches are desirable for traffic safety. Right-of-way requirements would typically vary upward from 250 feet depending upon cut and fill requirements.

Cross section "B" is typical for four lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 30 feet, but a wider median is desirable. Design requirements for slopes and drainage would be similar to **cross section "A"**, but there may be some variation from this depending on right-of-way constraints.

Cross section "C", seven lane urban, and **cross section "D"**, five lane urban, are typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

Cross sections "E" and **"F"** are used on major thoroughfares where left turns are anticipated as a result of abutting development or frequent street intersections.

Cross section "G" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 24 feet is recommended with 30 feet being desirable.

Typical **cross section "H"** is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections.

Thoroughfares which are proposed to function as one-way traffic carriers would typically require **cross section "I"**. **Cross section "J"** and **"K"** are usually recommended for minor thoroughfares since these facilities usually serve both land service and traffic service functions. **Cross section "J"** would be used on those minor thoroughfares were parking both sides is needed as a result of more concentrated development.

Cross section "L" is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time.

The curb and gutter urban cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk further away from the street to provide added separation for pedestrians or for aesthetic reason, additional right-of-way must be provided to insure adequate setback for utility poles.

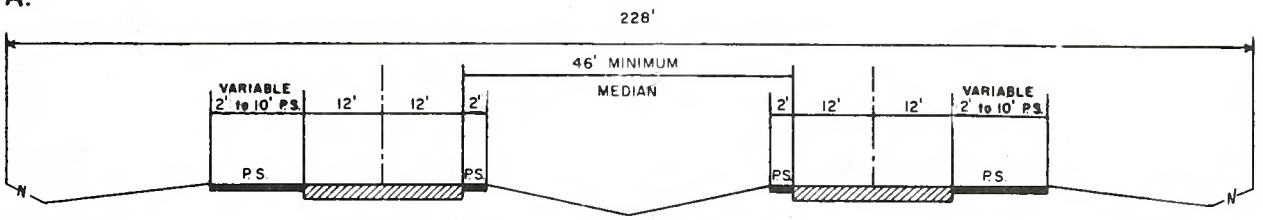
Right-of-way shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

If there is sufficient bicycle traffic to warrant a bicycle lane or bikeway, additional right-of-way may be required to allow for the bicycle facilities. The North Carolina Bicycle Facility and Program Handbook should be consulted for the design standards for bicycle facilities.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available right-of-way.

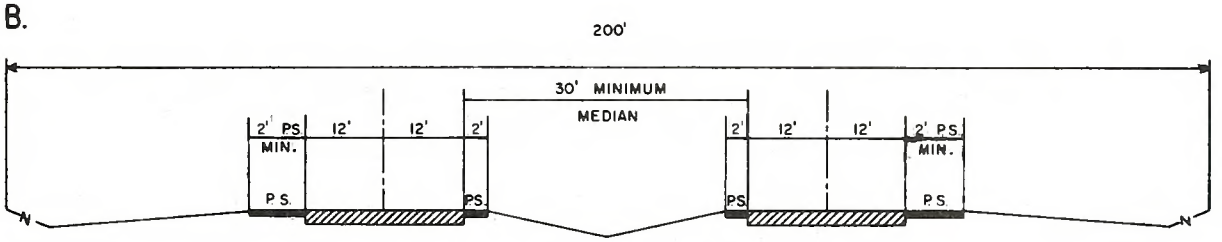
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



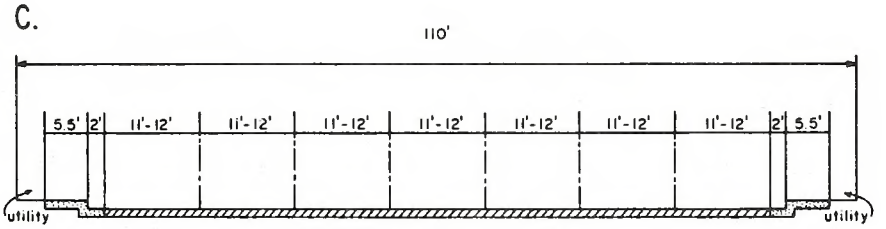
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



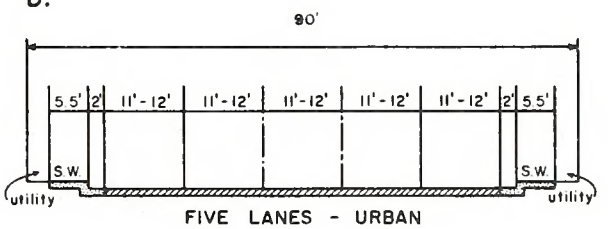
FOUR LANES DIVIDED WITH MEDIAN - RURAL

C.



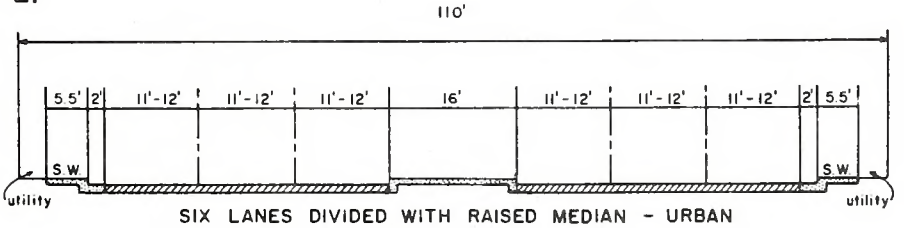
SEVEN LANES - URBAN

D.



FIVE LANES - URBAN

E.

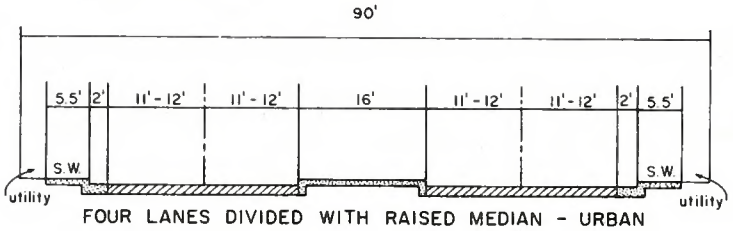


SIX LANES DIVIDED WITH RAISED MEDIAN - URBAN

FIGURE 9

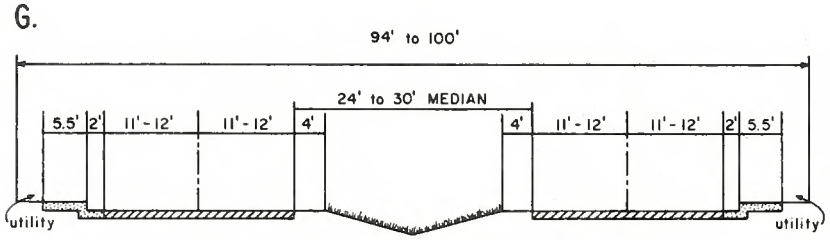
TYPICAL THOROUGHFARE CROSS SECTIONS
(CONTINUED)

F.



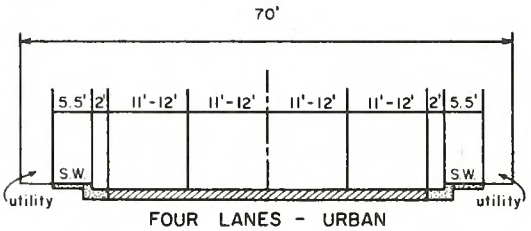
FOUR LANES DIVIDED WITH RAISED MEDIAN - URBAN

G.



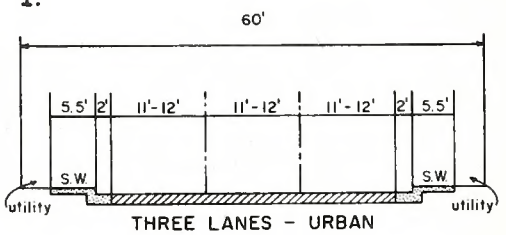
FOUR LANES DIVIDED - URBAN BOULEVARD
GRASS MEDIAN

H.



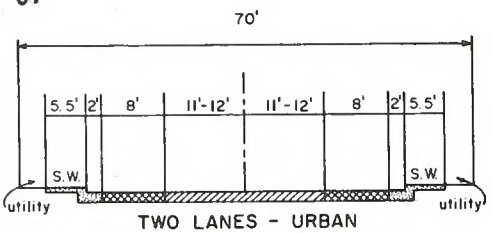
FOUR LANES - URBAN

I.



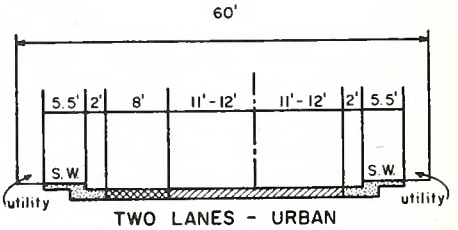
THREE LANES - URBAN

J.



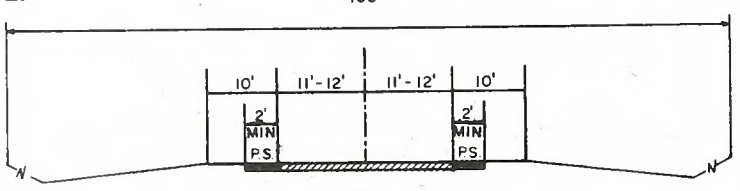
TWO LANES - URBAN
PARKING ON EACH SIDE

K.



TWO LANES - URBAN
PARKING ON ONE SIDE

L.



TWO LANES - RURAL

TABLE 5
THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

FACILITY & SECTION	DIST MI	EXISTING X-SECTION RDWY FT	EXISTING X-SECTION ROW FT	LNS #	CAPACITY CURRENT (FUTURE)	1991 ADTS	2020 ADTS	RECOMMENDED X - SECTION RDWAY (ULT)	RECOMMENDED X - SECTION ROW (ULT)
US 19E									
West PAB - WCL	0.93	24	300	2	(48,000)	8,200	17,500	TIP -	2519
WCL - NC 226	0.83	48	300	4	48,000	8,600	26,500	NC	NC
NC 226 - MP 6.13	1.65	48	300	4	48,000	10,000	17,300	NC	NC
MP 6.13 - East PAB	0.56	24	100	2	(48,000)	11,500	19,000	TIP -	2520
NC 226									
South PAB - SCL	1.33	22	100	2	(37,000)	8,000	18,000	D	ADQ
SCL - MP 4.20	0.17	24	100	2	(37,000)	13,000	26,300	D	ADQ
MP 4.20 - US 19E	0.49	36	100	3	(37,000)	11,000	25,400	D	ADQ
US 19E - MP 4.87	0.18	24	100	2	12,000	4,500	3,200	NC	NC
MP 4.87 - MP 5.05	0.18	36	100	3	14,000	4,500	3,200	NC	NC
MP 5.05 - SR 1275	0.10	40	60	3	14,000	4,500	8,200	NC	NC
SR 1275 - MP 5.24	0.09	22	60	2	9,500	7,500	3,600	L	(100)
MP 5.24 - North PAB	2.16	24	60	2	13,000	6,000	12,500	NC	NC
NC 226 BYPASS									
US 19E - NC 226	1.10	--	---	4	(48,000)	----	14,400	TIP -	2119
SR 1275 (Oak St.)									
NC 226 - MP 0.03	0.03	36	60	2	12,000	7,500	7,400	NC	NC
MP 0.03 - MP 0.05	0.02	36	---	3	14,000	7,500	7,400	NC	NC
MP 0.05 - MP 0.19	0.14	40	---	2	12,000	7,500	7,400	NC	NC
MP 0.19 - MP 0.32	0.13	36	---	2	12,000	7,500	7,400	NC	NC
MP 0.32 - MP 0.42	0.10	32	---	2	12,000	7,500	11,000	NC	NC
MP 0.42 - MP 0.67	0.25	24	---	2	12,000	7,500	5,400	NC	NC
MP 0.67 - US 19E	0.06	32	300	2	12,000	7,500	2,700	NC	NC
SR 1285									
SR 1275 - US 19E	0.48	24	---	2	12,000	----	2,700	NC	NC
SR 1122									
US 19E - Altapass Hwy	1.60	20	60	2	(11,000)	700	1,000	L	(100)

PAB - Planning Area Boundary

ADQ - Adequate

NC - No Change

MP - Mile Post

TABLE 5
THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

FACILITY & SECTION	DIST MI	EXISTING X-SECTION RDWY FT	EXISTING X-SECTION ROW FT	EXISTING X-SECTION LNS #	CAPACITY CURRENT (FUTURE)	1991 ADTS	2020 ADTS	RECOMMENDED X - SECTION RDWAY (ULT)	RECOMMENDED X - SECTION ROW (ULT)
SR 1121 (Altapass Hwy)									
SR 1275 - MP 0.20	0.20	20	---	2	(12,000)	8,600	4,000	L	(100)
MP 0.20 - US 19E	0.10	36	---	2	12,000	8,600	4,000	NC	NC
US 19E - MP 0.35	0.05	24	100	2	(14,000)	8,600	13,300	I	NC
MP 0.35 - South PAB	1.10	20	---	2	(12,000)	2,900	5,500	L	(100)
Summit Ave. (SR 1274)									
NC 226 - MP 1.49	0.08	28	60	2	12,000	1,400	3,800	NC	NC
MP 1.49 - MP 2.12	0.63	22	60	2	11,000	1,400	1,500	NC	NC
MP 2.12 - NC 226	0.09	24	60	2	12,000	1,400	1,500	NC	NC
Greenwood Ave.(SR 1274)									
US 19E - MP 0.35	0.35	24	60	2	12,000	1,000	600	NC	NC
MP 0.35 - Bell St.	0.38	20	60	2	(11,000)	1,200	8,800	L	(100)
Bell St. - MP 0.92	0.19	24	60	2	12,000	1,500	6,200	NC	NC
MP 0.92 - MP 1.35	0.43	22	60	2	11,000	2,500	5,400	NC	NC
MP 1.35 - NC 226	0.06	28	60	2	12,000	2,500	6,400	NC	NC

APPENDIX B
RECOMMENDED SUBDIVISION ORDINANCES

DEFINITIONS:

I. Streets and Roads:

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.

2. Minor Arterial - A rural roadway joining cities and larger towns and providing intra-state and inter-county service at relatively high overall travel speeds with minimum interference to through movement.

3. Major Collector - a road which serves major intra-county travel corridors and traffic generators and provides access to the arterial system.

4. Minor Collector - A road which provides service to small local communities and traffic generators and provides access to the Major Collector System.

5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of Interstate, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares preform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through-traffic movements and may also serve abutting property.

3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

C. Specific Type Rural or Urban Streets

1. Freeway - Divided multilane highway designed to carry large volumes of traffic at high speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. (Design speed 70 mph, Operating speed 55 to 65 mph)

2. Secondary Freeway - A divided multilane roadway designed to carry moderate volumes of traffic at moderate speeds. The facility provides for the continuous flow of traffic thorough full control of access and the provision of interchanges or grade separation with no access at cross roads, and no traffic signals. (Design speed 50-55 mph, Operating speed 40-45 mph)

3. Parkway - A divided multilane roadway designed for noncommercial traffic, with full or partial control of access. Grade separations are provided at major intersections and there are no traffic signals.

4. Expressway - A divided multilane roadway designed to carry heavy volumes of traffic with full or partial control of access. Interchanges are provided at major intersections. There may be access to service roads and local streets, but there will be no signalized intersections.

5. Secondary Expressway - A divided multilane roadway designed to carry moderate volumes of traffic at moderate speeds. This facility may have partial control of access with right turn in and right turn out access to abutting property, and interchanges at major intersections. Some minor intersections may have traffic signal control.

6. Urban Arterial - Multilane roadway with signalized intersections, and access to abutting property. May have grass or barrier type median, or middle left turn lane.

7. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

8. Local Residential Street - Cul-de-sacs, loop streets less than 2,500 feet in length, or streets less than one mile in length that do not connect thoroughfares, or serve major traffic collectors, and do not collect traffic from more than 100 dwelling units.

9. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

10. Frontage Road - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

11. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be erected.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development of or both. The word "lot" includes the words "plat" and "parcel".

III. Subdivision

A. Subdivider - Any person, firm corporation or official agent thereof, who subdivides of develops any land deemed to be subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination or recombination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than ten acres were no street right-of-way dedication is involved, (3) widening of opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than two acres into not more than three lots, where no street right-or-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

D. Reservation - Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

I. Streets and Roads

The design of all roads within Spruce Pine shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the town of Spruce Pine.

The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-of-way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

	Min. ROW
1. Rural	
a. Principle Arterial	
Freeways	350 ft.
Other	200 ft.
b. Minor Arterial	100 ft.
c. Major Collector	100 ft.
d. Minor Collector	80 ft.
e. Local Road	60 ft.*
2. Urban	
a. Major Thoroughfare other than Freeway and Expressway	90 ft.
b. Minor Thoroughfare	70 ft.
c. Local Street	60 ft.*
d. Cal-de-sec	Variable**

The subdivider will only be required to dedicate a maximum of 100 feet of right-of-way. In cases where over 100 feet of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 100 feet. On all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than sixty feet in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. when the said adjoining property is subdivided, the remainder of the full required right-of-way shall be dedicated.

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* The desirable minimum right-of-way (ROW) is 60 ft. If curb and gutter is provided, 50 feet of ROW is adequate on local residential streets.

** The ROW dimension will depend on radius used for vehicular turnaround. Distance from edge of pavement of turnaround to ROW should not be less than distance from edge of pavement to ROW on street approaching turnaround.

B. Street Widths - Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential
   Curb and Gutter section: 34 feet, face to face of curb Shoulder section: 20 feet to edge of pavement, 6 foot shoulders

C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

1. Design Speed - The design speed for a roadway should be a minimum of 5 mph greater than the posted speed limit. The design speeds for various facilities shall be:

DESIGN SPEEDS			
Facility Type	Design Speed		
	Desirable	Minimum	
		Level	Rolling
RURAL			
Minor Collector Roads	60	50	40
Local roads including Residential Collectors and Local Residential	50	50*	40*
URBAN			
Major Thoroughfares other than Freeway or Expressway	60	50	50
Minor Thoroughfares	60	50	40
Local Thoroughfares	40	40**	30**

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* Based on projected annual average daily traffic of 400-750. In cases where road will serve a limited area and small number of dwelling units, minimum design speeds can be reduced further.

** Based on projected annual average daily traffic of 50-250.

2. Maximum and Minimum Grades

a. The maximum grades in percent shall be:

MAXIMUM VERTICAL GRADE		
Design Speed	Terrain	
	Level	Rolling
60	4	5
50	5	6
40	6	7
30		9

b. Minimum grade should not be less than 0.5%.

c. Grades for 100 feet each way from intersections (measured from edge of pavement) should not exceed 5%.

d. For streets and roads with projected annual average daily traffic less than 250 vehicles and grades less than 500 feet long, values may be 150% of that shown in the above table.

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters:

SIGHT DISTANCE				
Design Speed	30	40	50	60
Stopping Sight Distance				
Minimum (ft.)	200	275	400	525
Desirable Minimum (ft.)	200	325	475	650
Minimum K* Value for:				
Crest curve	30	80	160	310
Sag curve	40	70	110	160

(General practice calls for vertical curves to be multiples of 50 feet. Calculated lengths shall be rounded up in each case.)

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* K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in feet of the vertical curve which will provide the desired sight distance.

Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1990".

4. The "Superelevation Table" below shows the maximum degree of curve and related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter of 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

SUPERELEVATION TABLE

Design Speed	Maximum e*	Minimum Radius ft.	Max. Deg. of Curve
30	0.04	302	19 00′
40	0.04	573	10 00′
50	0.04	955	6 00′
60	0.04	1,528	3 45′
30	0.06	273	21 00′
40	0.06	509	11 15′
50	0.06	849	6 45′
60	0.06	1,380	4 15′
30	0.08	252	22 45′
40	0.08	468	12 15′
50	0.08	764	7 30′
60	0.08	1,206	4 45′

e = rate of roadway superelevation, foot per foot

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 200 feet between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than seven hundred (500) feet in length (for control of speed, visual detection of a dead end street, and for fire protection). The distance from the edge of pavement on the vehicular turnaround to the right-of-way line should not be less than the distance from the edge of pavement to right-of-

way line on the street approaching the turnaround. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purpose accept that this requirement may be waived where other definite and assured provisions are made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least twenty (20) feet.

3. Deadend alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turnaround facilities at the deadend as may be required by the Planning Board.

G. Permits for Connection to State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 30 feet from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 6 feet from the face of curb.

I. Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:

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a. Shoulder section approach

i. Under 800 ADT design year

Minimum 28 feet width face to face of parapets of rails or pavement width plus 10 feet, whichever is greater.

ii. 800 - 2000 ADT design year

Minimum 34 feet width face to face of parapets of rails or pavement width plus 12 feet, whichever is greater.

iii. Over 2000 ADT design year

Minimum width of 40 feet, desirable width of 44 feet width face to face of parapets or rails.

b. Curbs and gutter approach

i. Under 800 ADT design year

Minimum 24 feet face to face of curbs.

ii. Over 800 ADT design year

Width of approach pavement measured face to face of curbs.

Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be 1'6" minimum, or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

a. Shoulder section approach - Width of approach pavement plus width of useable shoulders on the approach left and right. (Shoulder width 8' minimum, 10' desirable.)

b. Curb and gutter approach - Width of approach pavement measured face to face of curbs.